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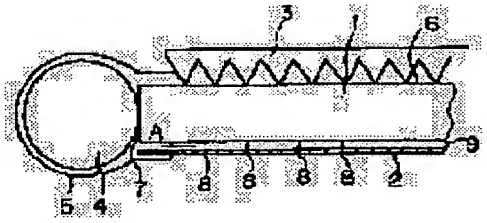
(54) SURFACE LIGHT SOURCE ELEMENT

(57)Abstract:
PURPOSE: To provide the surface light source element which is suitable as a back illuminating means of a liquid crystal display element, etc., and emits light with uniform luminance from the whole surface, and also, whose efficiency is high.
CONSTITUTION: A side face 7 of a transparent light guiding body 1 is set as an incident surface and a light source 4 is allowed to adhere closely, and also, by a reflector 5, light of the light source 4 is guided into the light guiding body 1 without waste. An emitting surface 6 of the light guiding body 1 is smoothed and decreases a loss of an emitted light. To the emitting surface 6, an element 3 having a prism unit is allowed to adhere closely, and also, the opposite surface 9 of the emitting surface 6 of the transparent light guiding body 1 is constituted so that the part whose surface is roughened and a smooth part 8 exist alternately, and moreover, a ratio of the smooth part increases as it draws near the light incident surface 7. Also, the reflecting surface 2 is provided in the vicinity of the opposite surface 9.



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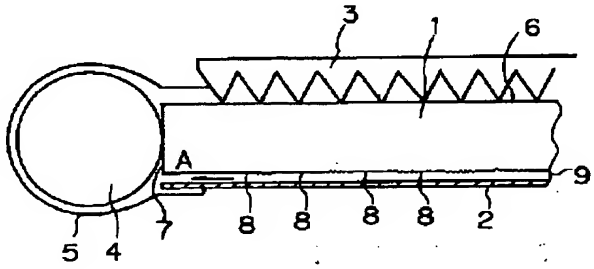
(54)【発明の名称】　面光源素子

(57)【要約】　(修正有)

【目的】液晶表示素子などの背面照明手段として好適な全表面から均一な輝度で発光し、しかも効率の高い面光源素子を提供する。

【構成】透明な導光体１の側面７を入射面として光源４を密着させ、またリフレクタ５により無駄なく光源４の光を導光体１に導入する。導光体１の出射面６は平滑にして出射光の損失を少なくする。出射面６にはプリズム単位を有するエレメント３を密着させ、また透明導光体１の出射面６の反対面９は粗面化された部分と平滑な部分８が交互に存在し、かつ平滑部分の割合が光入射面７に近づくに従って増加するようにする。また反対面９に接近して反射面２を設ける。



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【特許請求の範囲】

【請求項１】　少なくとも一つの側端を光入射面とし、これと直交する１つの面を光出射面とし、かつ該光出射面の反対面に光反射層を備えた透明導光体（１）と、該透明導光体の光出射面からの光を所定の方向に光を出射させる多数のプリズム単位を有するエレメント（２）とから構成され、

透明導光体の光出射面とその反対面の少なくとも一方に、透明導光体の光入射面から入射した光を当該光の進行方向に対して斜め方向に出射させる指向性出射機能と、光出射面から出射する光の輝度値を光出射面全面で均一化させる制御機能とを持たせたことを特徴とする面光源素子。

【請求項２】　透明導光体が、指向性光出射機能を持つ粗面化された光出射面と、その少なくとも１つの端部側面に形成された光入射面と、該光出射面の反対面に設けられた光反射層とを有し、前記粗面化された光出射面に平滑部分を設け、該平滑部分の割合を前記光入射面に近づくに従って増加させて光出射面から出射する光の輝度値を光出射面全面で均一化させる制御機能を持たせたことを特徴とする請求項１記載の面光源素子。

【請求項３】　透明導光体が、光出射面と、その少なくとも１つの端部側面に形成された光入射面と、指向性光出射機能を持つ粗面化された、光出射面の反対面と、該反対面に設けられた光反射層とを有し、前記粗面化された反対面に平滑部分を設け、該平滑部分の割合を前記光入射面に近づくに従って増加させて光出射面から出射する光の輝度値を光出射面全面で均一化させる制御機能を持たせたことを特徴とする請求項１記載の面光源素子。

【請求項４】　透明導光体が、指向性光出射機能を持つ多数のレンズ単位を有する光出射面と、その少なくとも１つの端部側面に形成された光入射面と、該光出射面の反対面に設けられた光反射層とを有し、前記多数のレンズ単位を有する光出射面に平滑部分を設け、該平滑部分の割合を前記光入射面に近づくに従って増加させて光出射面から出射する光の輝度値を光出射面全面で均一化させる制御機能を持たせたことを特徴とする請求項１記載の面光源素子。

【請求項５】　透明導光体が、光出射面と、その少なくとも１つの端部側面に形成された光入射面と、指向性出射機能を持つ多数のレンズ単位を有する、光出射面の反対面と、該反対面に設けられた光反射層とを有し、該多数のレンズ単位を有する反対面に平滑部分を設け、該平滑部分の割合を前記光入射面に近づくに従って増加させて光出射面から出射する光の輝度値を光出射面全面で均一化させる制御機能を持たせたことを特徴とする請求項１記載の面光源素子。

【請求項６】　透明導光体として、射出成形により得られた透明導光体を用いることを特徴とする請求項１記載の面光源素子。

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【請求項７】　透明導光体として、射出成形により得られた透明導光体を用いることを特徴とする請求項２記載の面光源素子。

【請求項８】　透明導光体として、射出成形により得られた透明導光体を用いることを特徴とする請求項３記載の面光源素子。

【請求項９】　透明導光体として、射出成形により得られた透明導光体を用いることを特徴とする請求項４記載の面光源素子。

【請求項１０】　透明導光体として、射出成形により得られた透明導光体を用いることを特徴とする請求項５記載の面光源素子。

【請求項１１】　透明導光体に形成された粗面の曇価が３０％以上であることを特徴とする請求項２記載の面光源素子。

【請求項１２】　透明導光体に形成された粗面の曇価が３０％以上であることを特徴とする請求項３記載の面光源素子。

【請求項１３】　透明導光体がアクリル樹脂で構成されていることを特徴とする請求項１記載の面光源素子。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、面光源装置に用いられる面光源素子に関し、特に、液晶表示素子などの背面照明手段として好適に使用することができるものに関する。

【０００２】

【従来の技術】従来、液晶表示装置などの背面照明（バックライト）手段としては、光源に線状ランプを用い、回転放物線型リフレクターの焦点に置き、ランプ上部に乳白色の拡散板を置いた構造が一般的である。この構造の装置においては、リフレクターの形状や拡散板の拡散率を調整することにより改良が図られている。

【０００３】また、線状ランプと導光体を組み合わせ、導光体の形状を点光源近似によってシュミレートし、ある方向の出射光を集光するように近似曲線形状に加工した装置、光の進行方向に沿って導光体の厚みを変えた装置、光源からの距離によってプリズム角を変えたレンチキュラーを使用した装置、更に、これらを組み合わせたものなどがある。

【０００４】近年、面光源素子は液晶表示素子として使われてきているが、従来の面光源素子を使用して表示品質を高めようとすると、特に、１０～１２インチサイズの大型の表示用になると面光源素子部分だけの厚みが２０～３０㎜となって薄型の面光源素子としての要望を満たすことができない。

【０００５】一方、アクリル樹脂などの板状透明材料を透明導光体とし、この透明導光体の端部から光を入射し、導光体の上面もしくは下面から光を出射するエッジライト方式の面光源装置が種々提案されている。しかし

ながら、１０～１２インチサイズの大型の液晶表示装置では、光源からの距離に応じて暗くなったり、ムラが生じるなどして必ずしも良好な表示を行うことができなかった。

【０００６】これに対して、導光体の厚さを、ランプからの距離に応じて薄くするなど、また、光の行路を幾何学的に変えるなどの手段が講じられているが、精密な加工を必要とする特殊形状とする必要があり、製造コスト上に不都合がある。しかも、光の利用効率が低かった。

【０００７】

【発明が解決しようとする課題】最近、エッジライト方式の面光源素子について、特開平１－２４５２２０号公報には、導光体の光出射面の対向面に光入射部から離れるに従って光散乱物質を密に塗布或いは付着し、又は光散乱反射面を設置してその表面に同様に光散乱物質を塗布或いは付着した表示方法が開示され、また特開平１－１０７４０６号公報には透明板表面に細かい斑点（散乱物質）が設けられ、その斑点パターンが互いに異なる複数の透明板を重ねることにより、光拡散板の全面を均一に明るくすることができる面照明装置が報告されている。

【０００８】しかしながら、これらの方法においては、一般的に散乱物質として光不透過な無機物（多くの場合、酸化チタンや硫酸バリウム等の白色顔料）が使用されるために、この散乱物質に当った光が散乱する際に、光吸収等の光のロスが発生し、出射光の輝度の低下が生じる。

【０００９】大江は実開昭６１－１７１００１号公報、米国特許第４７２９０６８号公報において導光体上に、光導光体と拡散層の中間の性質を示す層を介して拡散層を設け、その上に出射光の均一化を得るために出射光調整部材を設けた光拡散装置を報告している。

【００１０】また、本発明者らも特開平１－２４４４９０号公報および特開平１－２５２９３３号公報において、導光体の光出射面とその対面の少なくとも一方の面をレンズ状あるいは梨地面とし、その光出射面上に出射光分布の逆数に見合う光反射パターンを有する出射光調整部材および光拡散板を配置するエッジライト方式の面光源素子を提案した。

【００１１】これらの出射光調整部材を使用した光拡散装置および面光源素子は、出射光の均一性の点では優れた改良効果を示すものの、出射光調整部材において反射した光が再利用できず、出射光の輝度は調整前輝度の最小値近くまで低くなることが判明した。

【００１２】本発明者らは、特開平２－１７号公報および特開平２－８４６１８号公報において、導光体の光出射面とその対面の少なくとも一方の面をレンズ状あるいは梨地面とし、その光出射面上に所定の方向に光を出射させるプリズムを設置した面光源素子を提案した。これらの面光源素子を上記液晶カラーパソコン装置等に用いると、確かに使用者が見る方向に集中光が得られるようになったが、出射光の出射面における均一性の点では満足できるものが得られなかった。

【００１３】本発明は、光出射面全面で均一な明るさになり、かつ所定方向において高い輝度の出射光が得られる超薄型面光源素子を提供することを目的とするものである。

【００１４】

【課題を解決するための手段】本発明者は上述の状況に鑑み、種々の検討を行った結果、本発明を完成させるに至ったものである。

【００１５】本発明の面光源素子は、少なくとも一つの側端を光入射面とし、これと直交する１つの面を光出射面とし、かつ該光出射面の反対面に光反射層を備えた透明導光体（１）と、該透明導光体の光出射面からの光を所定の方向に光を出射させる多数のプリズム単位を有するエレメント（２）とから構成され、透明導光体の光出射面とその反対面の少なくとも一方に、透明導光体の光入射面から入射した光を当該光の進行方向に対して斜め方向に出射させる指向性出射機能と、光出射面から出射する光の輝度値を光出射面全面で均一化させる制御機能とを持たせたことを特徴とするものである。

【００１６】光入射面から導光体に入射した内部光の光量は、光出射面からの出射、導光体内部の光吸収などにより、光入射面から離れるに従って減少するが、本発明の面光源素子は、平滑部分の割合を光入射面に近づくに従って増加するようにしたので、透明導光体を薄型にしても入射された光が光出射面の全面からほぼ均一な輝度値で出射される。また、透明導光体に入射された光は、無駄に消費されることがなく、光の利用効率が高いので、光源のワット数を増加させることなく、高い輝度の出射光が得られる。さらには光を所定の方向に光を出射させる多数のプリズム単位を有するエレメントを透明導光体の上に設置することで、所定の方向において高い輝度値を有する出射光が得られるものである。

【００１７】従って、本発明によれば、光出射面全面で均一な明るさになり、かつ所定の方向において高い輝度の出射光が得られる超薄型面光源素子を提供することができる。

【００１８】以下、この発明の面光源装置をさらに詳細に説明する。

【００１９】まず、本発明の面光源素子の基本的な原理について説明する。導光体の空気に対する光の屈折率ｎは、概ね、ｎ＝１．４～１．６であり、図１（ａ）に示すように導光体１の入射面７と出射平面６が直交しているようなエッジライティング形状では、臨界角が４５度前後であると原理的に出射平面から光が出射しない。なお、図１（ａ）において、４は蛍光灯などの光源、５はそのリフレクター、２は導光体１の出射平面６の反対側に形成された反射面である。

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【００２０】そのため、一般には図１（ｂ）に示すように、出射平面６を光散乱加工した平面６ａとしたり、反射面２を散乱反射面９ａとすることが行なわれる。

【００２１】本発明者らは、導光体からの出射光量を最も大きくするために、導光体表面とその対向面の一方あるいは双方の散乱加工の検討を行ったところ、それら表面を可能な限り均一に粗面加工を施す方法およびそれら表面に所定方向に光を出射させる多数のレンズ単位を設ける方法が、散乱物質を導光体表面とその対向面の一方あるいは双方に塗布する方法またはアクリル板重合時に散乱物質の層を表面に形成させる方法に比べて有効なことを見出した。

【００２２】一方、粗面加工を施した導光体の一端面にリフレクターとして銀蒸着ポリエステルフィルムを巻き付けた蛍光灯を置き、粗面加工面に密接して銀蒸着ポリエステルフィルムを反射材として配設して出射光の輝度を測定すると、蛍光灯から離れるに従って出射光の輝度は減衰してゆき、導光体の厚みの７０～８０倍の距離になると入射端近傍の輝度値の１／１０以下になる。これを図２中の線①に示す。

【００２３】本発明者らはこの不均一化を改善するために、先述したように特開平１－２４４４９０号公報および特開平１－２５２９３３号公報において、出射光調整用の透光性シートで輝度の均一化を行なうことを提案した。しかしながら、この方法では出射光の輝度の均一性は達成されたものの、出射光全体としての輝度値は入射端近傍の輝度値の１／１０～１．５／１０程度に低下し、導光体内に入射した光エネルギーの利用は効率的に行なわれていなかった。これを図２中の線②に示す。これは、出射光調整用透光性シート自体が出射してくる光をカットするだけのもので、その調整パターンにおいて光を反射して再利用できないことによるものである。

【００２４】そこで、本発明者らは、このような観点から、入射してくる光をできる限り有効に利用するために出射光調整用透光性シートの調整パターンや、また先述した特開平１－２４５２２０号公報のように散乱物質を光入射部から離れるに従って密に、光出射面の対面に塗布することによって光の出射を行うのではなく、本発明者らが特開平２－１７号公報、特開平２－８４６１８号公報、特開平２－１７６６２９号公報に報告しているような透明導光体でかつ本来出射量が大きい透明導光体で、光学的に最もロスの少ない界面反射を用いて出射光量の調整を行い、出射光面の輝度値の均一化を試みた。

【００２５】すなわち、透明導光体の光出射面とその反対面の少なくとも一方に、透明導光体の光入射面から入射した光を当該光の進行方向に対して斜め方向に出射させる指向性出射機能を持つ、粗面または多数のレンズ単位を設けるとともに、これら粗面または多数のレンズ単位を有する面に平滑部分を設け、しかもその平滑部分の割合を光入射面に近づくに従って増加させ、透明導光体

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の光出射面から出射する光の輝度値を光出射面の全体で均一化させる制御機能を持たせることによって、出射光の全体としての輝度値が入射端近傍の輝度値の約３／１０に増加させることができ、しかも光出射面全体として均一な輝度値を示す透明導光体を得ることができることを見出した。これを図２中の線③に示す。本発明の面光源素子はこの透明導光体を用い、かつ先述したように所定方向に光を有効的に出射させるために、該透明導光体の上に多数のプリズム単位を有するエレメントを設置したものである。

【００２６】

【実施例】この発明の面光源素子を、以下の実施例により、具体的に説明する。

【００２７】面光源素子

図３に、この発明による面光源素子を組み込んだ背面照明（バックライト）装置の一実施例を示し、また図４には図３に示す装置のIV－IV線の一部断面図を示す。

【００２８】この装置は、四角平板状の導光体１と、その光出射面６側に設置されたプリズム単位を有するエレメント３と、導光体１の端部側面（光入射面７）に設けられた１本の蛍光灯などの光源４と、この光源４を保持すると共に内面に設けられた反射面により入射面へ光を反射させるリフレクター５とから構成されている。導光体１の光出射面６の反対側には、光反射層２が設けられている。

【００２９】この発明の面光源素子の特徴は、導光体１の光出射面とその反対面の少なくとも一方に、導光体１の光入射面７から入射した光をその進行方向に対して斜め方向に出射させる指向性出射機能を持つ粗面または多数のレンズ単位を設けると共に、これら粗面または多数のレンズ単位を有する面に平滑部分を設け、しかもその平滑部分の割合を光入射面に近づくに従って増加させ、導光体１の光出射面から出射する光の輝度値を光出射面の全面で均一化させる制御機能を持たせたことと該導光体の上に導光体から出射した光を所定の方向に出射させるために、プリズム単位を有するエレメントを設置することである。

【００３０】この実施例では、光出射面６の粗面化された反対面９に平滑部分８が設けられ、その平滑部分８の割合が、図４の矢印Ａに示すように、光入射面７に近づくに従って増加するように構成されている。

【００３１】導光体の平滑部分の増加する割合、平滑部分の形状およびパターン、導光体の材質や形状、光源の種類、光出射・反射面の加工度などに応じて適宜に選択、変更して決定することができる。

【００３２】平滑部分のパターン例を、図５（ａ）～（ｅ）に例示する。これらいずれの例も、平滑部分８の割合が、図５中の矢印Ａに示すように光入射面７に近づくに従って増加する。

【００３３】本発明においては、透明導光体の光出射面

からの光を所定の方向に光を出射させるために多数のプリズム単位を有するエレメントを用いる。図１（ｂ）に示すように、出射面を散乱加工して出射平面６ａおよび９ａとした場合には、出射面の法線に対し６０～７０度方向にほとんどの光が出射している。このような方向を法線方向に変換させるために、多数のプリズム単位を有するエレメントを用いる。

【００３４】図６（ａ）、（ｂ）には透明導光体の光出射面からの光を所定の方向に光を出射させる多数のプリズム単位を有するエレメント（２）のプリズムを拡大した図である。同図において、２０、２１はそれぞれ透明導光体（１）からの右側方向、左側方向への出射光、θ１、θ２はそれぞれ、法線とプリズム面３０、３１がなす角、３２は出射面である。またφ１～φ６およびφ１～φ６はそれぞれ、プリズム単位の各面域は基準線に対する角度を示したものであり、その角度の取り方は図６（ａ）、（ｂ）に示す通りである。

【００３５】出射光２１のようにプリズムの右側より入射する場合においては、プリズム面３０から入射し、プリズム面３１で全反射した後、出射面３２から所定角度φ６で出射する。また、出射光２０のようにプリズムの左側から入射する場合においては、プリズム面３１から入射し、プリズム面３０で全反射した後、出射面３２から所定角度φ６で出射する。導光体からの出射角は、法線に対して対称となるとは限らないが、プリズム角（図７のθ１、θ２）を変えることにより所望の出射角（φ６およびφ６）を得ることが可能である。

【００３６】プリズム単位を有するエレメント（２）の導光体への設置は、導光体端部のみを接着剤などによる接着や圧着による強制密着による方法の他、単に載置するのみでも行なうことができる。また、導光体とエレメント（２）との間を密着させ、もしくは薄い空気層を介して積層することもできる。

【００３７】この発明において透明導光体（１）は、アクリル樹脂、ポリカーボネート樹脂、塩化ビニル樹脂などの透明樹脂、ガラスや石英などの透明無機材料から得ることができ、特に可視光透過率の大きいアクリル樹脂が好適である。この導光体１の成形方法は、適宜に選択、変更して行なうことができる。

【００３８】この発明における光源４は、特に限定されず、連続した線状光源である蛍光灯、フィラメントランプや、入射面に沿って配置された複数の点光源、側面から光を漏光する光伝送体とこの光伝送体の端部入射面に設けられる光源とを組み合わせた光源装置などを光源として用いることができる。

【００３９】この発明における面光源素子の反射層２は、フィルムに金属（銀、アルミニウムなど）を蒸着した反射フィルムなどを積層して形成することができる。この反射材としては、反射率の高いものが好ましい。

【００４０】この発明において、導光体１は、光出射面６とその反対面の少なくとも一方が粗面化されているか或いは所定の方向に光を出射させる多数のレンズ単位が形成されている必要がある。また、粗面化され或いは多数のレンズ単位が形成された面には、平滑部分が光入射面に近づくに従って増加するように設けられている必要がある。

【００４１】この発明の好ましい態様にあっては、導光体１の平滑部分８の表面は、光学的平面であることが好ましく、特に、鏡面化されていることが望ましい。これは光学的平面に対して臨界反射角以上の入射角で入射した光は殆どロスされることなく反射され漏洩光とはならないことから、光を有効に利用でき、光出射面全体の輝度を向上させることができるからである。

【００４２】この発明で用いられるレンズ単位の形状は、特に限定されず、例えば本発明者らが特開平２－１７号公報で提案しているような形状のレンズ単位が使用できる。

【００４３】図７（ａ）、（ｂ）に種々のレンズ形状を有するレンズ４０を例示する。

【００４４】この発明で用いられる粗面化された面の性能としては、粗面化部分の曇価が約３０％以上、とりわけ５０％以上あることが好ましい。

【００４５】この発明の面光源素子は、上記の実施例に限定されず、種々の変形例が可能である。例えば、上記実施例では、光出射面６の粗面化された反対面９に平滑部分８が設けられているが、図８に示すように、粗面化された光出射面６に平滑部分８を設けることができ、図８中の矢印Ａに示すように光入射面７に近づくに従って平滑部分８の面積率を増加させる構成とすることもできる。

【００４６】更に、図９に示すように、光出射面６およびその反対面９の粗面化された両面に平滑部分を設けることができ、図９の矢印Ａに示すように光入射面７に近づくに従って平滑部分の面積率を増加させる構成とすることもできる。

【００４７】また、上記実施例では、導光体１の一端側にのみ光源４を設けた構成としたが、図１０に示すように、光源４を導光体１の両端部に配置することもできる。

【００４８】<u>面光源素子の調整方法</u>

この発明による面光源素子は、種々の方法により調整、製造することができる。

【００４９】例えば、この発明において、導光体の粗面化された面あるいはレンズ単位を有する面に平滑部分を設ける場合には、粗面化された面あるいはレンズ単位を有する面に平滑部分を設ける方法、平滑面に粗面化部分あるいはレンズ単位を設ける方法のいずれの方法を用いても目的とする導光体を作製することができる。例えば、サンドブラストやエッチングなどの粗面化処理により、所望の粗面パターンや表面荒さを有する金型あるい

は特定のレンズ単位と平滑部分を有する金型を準備し、これらの金型を用いて樹脂を射出や熱プレスにより成形して、粗面化されたあるいはレンズ単位を有する光出射面とその反対面の少なくとも一方に、所定の平滑部分を設けた導光体を得ることができる。特に射出成形法は、精度および成形スピードの点において優れており、好ましい成形法である。

【００５０】面光源素子の製造は、導光体、プリズム、反射材料などの各部材を準備し、これらを組み立てることにより実施することができる。

【００５１】詳細な実施例

（導光体用金型の作製）磨き黄銅板の片面にガラスビーズを吹きつけ、常法のホーミング法によって金属板表面を一様に粗面加工した板を作製する（金型－１）。

【００５２】平滑部の面積率分布が、図１１に示す分布となるようなグラデーションパターンをＣＡＤにて作製する。金型－１の表面に常法のホトリソグラフィー法により写真光学的にパターンを焼き付け現像し、粗面として残したい部分（図１２（ａ）に示す粗面部分５０と同一の部分）を皮膜で保護し、残りの部分をエメリー＃８００研度程度になるように研磨する。その後、保護膜を取り除き所定の平滑部を有する金型を作製する（金型－２）。

【００５３】これらと別に、黄銅板の表面をエメリー＃８００バフ研磨し、鏡面板を作製する（金型－３）。

【００５４】一方の面が金型－２と同じ面で、他方の面が金型－３と同じ面を有する射出成形用の入子金型を作製する（金型－４）。

【００５５】（導光体の作製）厚さ３㎜のアクリル樹脂板１５０㎜×２５０㎜を金型－２、金型－３の間にはさみ込んで熱プレスにより常法通りレプリカをとる。さらに図１２（ａ），（ｂ）に示すようなサイズ、パターン位置になるように切断し、切断した４辺は常法により鏡面になるように研磨する（導光体－１）。

【００５６】図１２（ａ）中の符号５０は粗面部分であり、また図１２（ｂ）において導光体１のサイズは、縦（Ｂ）２２５㎜、横（Ｃ）１３２㎜、ゾーン０の幅（Ｄ）１５㎜、有効幅（Ｅ：ゾーン１～１１の幅）２０５㎜、ゾーン１２の幅（Ｆ）５㎜である。

【００５７】全く同様なプロセスで厚さ３㎜のアクリル樹脂板１５０㎜×２５０㎜を金型－１、金型－３の間にはさみ込み、熱プレスによりレプリカをとり、切断、研磨して導光体を作製する（導光体－２）。

【００５８】比較例として、金型－２の粗面相当部分にスクリーン印刷でインクが印刷されるようなネガＥＰ画を作製し、これを用いてスクリーン印刷の刷版を作製する。厚さ３㎜のアクリル樹脂板１５０㎜×２５０㎜の片面に市販の白インキ（（株）セイコーアドバンス　ＶＩＣ　１２０ホワイト）を用いてスクリーン印刷した後、導光体－１、導光体－２と同様に切断、研磨して比較用導光体を作製する（導光体－３）。

【００５９】２００トン射出成形機により、金型－４を用い、シリンダー温度２８０℃にて、アクリル樹脂ペレット（アクリペット　ＶＨ　三菱レイヨン（株））から導光体を作製する（導光体－４）。

【００６０】（導光体－２の曇価測定）導光体－２の粗面部より５０㎜×５０㎜の紙片を切り出し、曇価をＡＳＴＭ－Ｄ１００３－６１に準じて測定して次式により曇価を求めた。

【００６１】曇価＝｛（拡散光透過率）／（全光線透過率）｝×１００％

その結果、導光体－２の曇価は６４．８であった。

（エレメント（２）の製作）ランプを短辺に１灯設置することから最終的な面光源素子よりの出射角を法線方向となる様に、プリズム角を等方性とし塔頂角６３°とした（$\theta 1 = \theta 2 = 31.5°$）。

【００６２】プリズムの先端角６３°のマルチプリズムパターンで、且つピッチ０．３８ｍｍの金型を作成し、熱プレスにより厚さ１ｍｍのアクリル樹脂板に熱転写し、プリズム単位を有するエレメント（２）とした。

【００６３】（面光源素子の組立）反射層をして１００μのポリエステルフィルムに銀蒸着を施したフィルムを１３２ｍｍ×２２５ｍｍに切断した。これを光反射体とする。ランプケースは（株）スカイアルミ製クリスタルホワイト（片面白色塗装アルミ板厚み０．２５ｍｍ）の白色部を内側にし、内径６ｍｍφで開口部３ｍｍとなるようなアパーチャー付き円筒を作成した。

【００６４】導光体の短辺に、図１２（ｂ）の０ゾーンが来てかつ粗面あるいは印刷面が反射層の銀蒸着面に近接するように導光体を載置しさらにその上にプリズム単位を有するエレメント（２）を載置し、この３点をまとめてランプケースのアパーチャー部にさし込む。このランプケースに（株）松下電機産業製ＫＣ１６２Ｔ４Ｅ５４Ｂ（４㎜φ×１６２㎜）のランプを挿入し、面光源素子とする。ランプ点灯用インバータは（株）ＴＤＫ製ＣＸＡ－Ｌ１０Ｌを用いＤＣ１２Ｖを印加して点灯する。

【００６５】（面光源素子の輝度測定）輝度計は（株）トプコンのＢＭ－５を用い、視野角１°、測定円１０～１５㎜φで測定する。測定点は図１３に示したゾーン１～ゾーン１１の中央部を測定する。面光源素子は全てランプを上にして所定の測定台に垂直に載せて固定しＤＣ１２Ｖを印加して点灯後、１５分以上ランプエイジングタイムを経て測定する。測定温度は２３℃±２℃の条件であった。

【００６６】（輝度測定結果）輝度の測定結果を表１及び図１３に示す。

【００６７】

【表１】

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ゾーン	本発明例		比較例			
	導光体－１		導光体－２		導光体－３	
	輝度	分布	輝度	分布	輝度	分布
１	５９６	０．９９２	１８１０	１．０００	２３８	０．９７９
２	５３９	０．８９７	１３４０	０．７４０	２１８	０．８９７
３	５４８	０．９１２	９４４	０．５２２	２０７	０．８５２
４	５５７	０．９２７	６１９	０．３４２	１９１	０．７８６
５	５２６	０．８７５	４３８	０．２４２	１９３	０．７９４
６	６０１	１．０００	３１１	０．１７２	２２２	０．９１４
７	５９３	０．９８７	２３４	０．１２９	２３２	０．９５５
８	５３５	０．８９０	１８８	０．１０４	２４３	１．０００
９	５４７	０．９１０	１５５	０．０８６	２２１	０．９０９
１０	５５４	０．９２２	１３０	０．０７２	１９３	０．７９４
１１	５６７	０．９４３	１１０	０．０６１	１９５	０．８０２
平均	５６０		５７１		２１４	

【００６８】（導光体および面光源素子の光出射光の角度分布の測定）試料を測定台上にランプｙが左側に位置するように載置し、図１４に示すように試料を回転させて所定の角度で決められた位置の輝度を測定する。

【００６９】導光体－１を用いた面光源素子よりプリズム単位を有するエレメント（２）を除去した試料を１－①とし、エレメント（２）を載置した試料を１－②とする。導光体－３を用いた面光源素子よりエレメント（２）を除去した試料を３－①とし、エレメント（２）を載置した試料を３－②とする。

【００７０】測定点はいずれの場合も図１２（ｂ）のゾーン６の中央に固定する。結果を図１５（ａ），（ｂ）に示す。

【００７１】表１、図１３および図１５から明らかなように、本発明例である導光体－１では光出射面全面からほぼ均一な輝度の出射光が出射される。しかも本発明の主旨であるエレメント（２）のない時の光出射光は図１５（ａ）試料１－①の測定例の様に６５°にピーク輝度を持つ分布光であり、エレメント（２）を載置した時はほとんどすべての出射光が試料の法線方向にピーク輝度を持つ分布光となる（図１５（ａ）試料１－②）。一方比較例である試料３も表１および図１３に示すように光出射面全面からほぼ均一な輝度の出射光が出射されるが、図１５試料３－①に示すようにエレメント（２）がなくとも、０°方向にピーク輝度を持つ分布光であり、エレメント（２）を設置してもピーク輝度の出射方向は変わらない。しかも驚くべきことは試料のサイズ、使用したランプおよび消費電力は変わらないのに、本発明例と比較例とでは、試料の法線方向の輝度値のほうが約２．５倍高い。また導光体－４から作製した面光源素子も導光体－１から作製した面光源素子と全く同様の結果が得られた。

【００７２】

【発明の効果】この発明の面光源素子は、透明導光体の光出射面とその反対面の少なくとも一方に、透明導光体の光入射面から入射した光を当該光の進行方向に対して斜め方向に出射させる指向性出射機能と、光出射面から出射する光の輝度値を光出射面全面で均一化させる制御機能とを持たせ、かつ該透明導光体の光出射面からの光を所定の方向に光を出射させる多数のプリズム単位を有するエレメント（２）とを設けることにより、透明導光体を薄型にしても、入射された光が光出射面の全面から所定の方向にほぼ均一な輝度値で出射される。また、この透明導光体は光の利用効率が高いので、光源のワット数を増加させることなく、高い輝度の出射光が得られる。

【００７３】従って、本発明によれば、光出射面全面で均一な明るさになり、かつ所定の方向において高い輝度の出射光が得られる超薄型面光源素子を提供することができる。

【図面の簡単な説明】

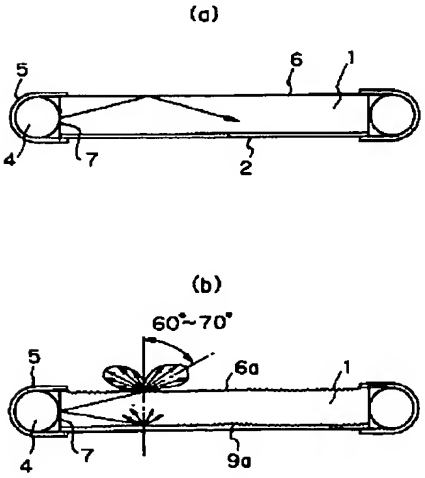
【図１】従来の面光源素子の構成を示す断面図である。

【図２】種々の面光源の光入射面からの距離に対応する輝度値の変化を示す図である。

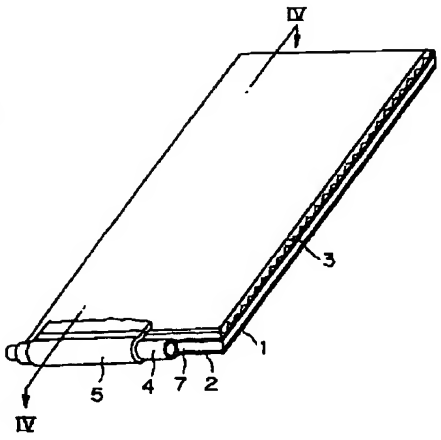
【図３】本発明による一実施例の面光源素子を組み込んだ背面照明装置の一部切欠斜視図である。
【図４】図３のIV－IV線の一部断面図である。
【図５】平滑部分の平面パターンの例を示す概略図である。
【図６】導光体より出射光のピーク光がプリズムに入射した時の光路解析図である。
【図７】種々のレンズ単位を例示する断面概略図である。
【図８】本発明の面光源素子の変形例を示す一部断面図である。
【図９】本発明の面光源素子の変形例を示す一部断面図である。
【図１０】背面照明装置の変形例を示す概略側面図である。
【図１１】実施例で用いた導光体作製用の金型に形成したパターンの平滑部の面積率分布を示すグラフである。
【図１２】作製した導光体の平面図である。
【図１３】各面光源素子の輝度分布の測定結果を示すグラフである。
【図１４】作製した面光源素子の指向性出射角の測定法を示す概略図である。
【図１５】作製した面光源素子の指向性出射角の測定結果を示すグラフである。
【符号の説明】

1	導光体
2	反射面
3	プリズム単位を有するエレメント（２）
4	光源
5	リフレクター
6	出射面
6 a	粗面化された出射面
7	導光体１の入射面
8	導光体１の平滑部分
9	光出射面の反対面
9 a	粗面化された光出射面の反対面
①	粗面化した導光体を用いた面光源の光入射面からの距離に対する輝度値の変化を示す図である。
②	出射光調整シートと粗面化した導光体を用いた面光源の光入射面からの距離に対する輝度値の変化を示す図である。
③	本発明で用いる導光体を用いた面光源の光入射面からの距離に対する 輝度値の変化を示す図である。
２０	透明導光体（１）からの右側方向への出射光
２１	透明導光体（１）からの左側方向への出射光
３０	プリズム面
３１	プリズム面
３２	出射面
θ1	法線とプリズム面３１がなす角
θ2	法線とプリズム面３０がなす角
φ1 ～φ6	プリズム単位の基準線に対する角度
φ1 ～φ6	プリズム単位の基準線に対する角度
４０	レンズ面
５０	粗面部

【図１】



【図３】



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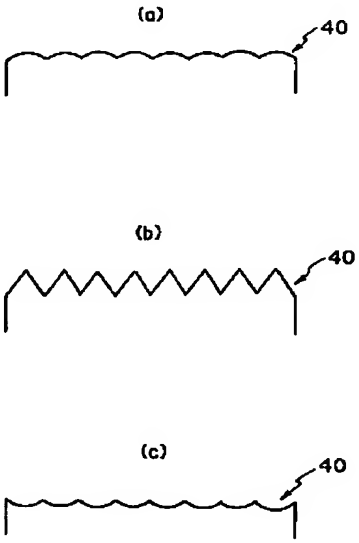
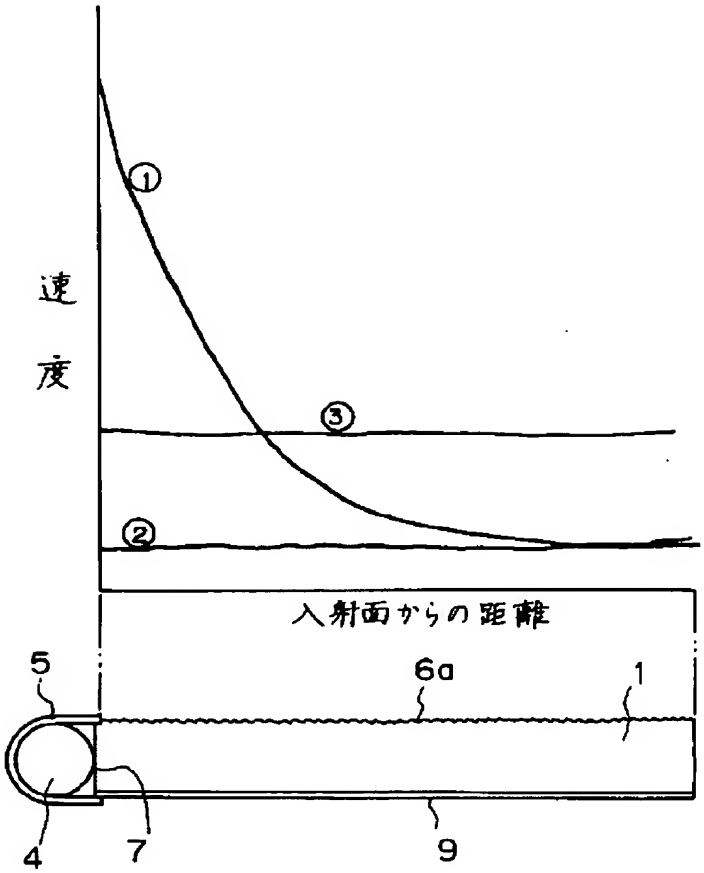


【図２】



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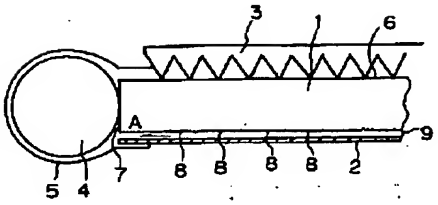

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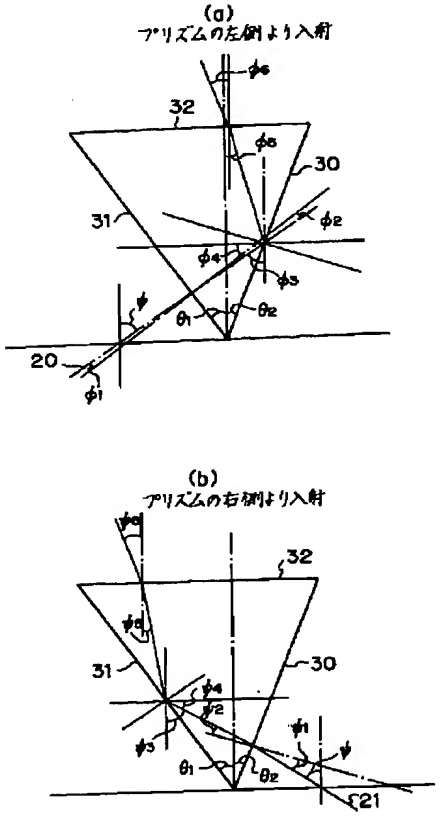

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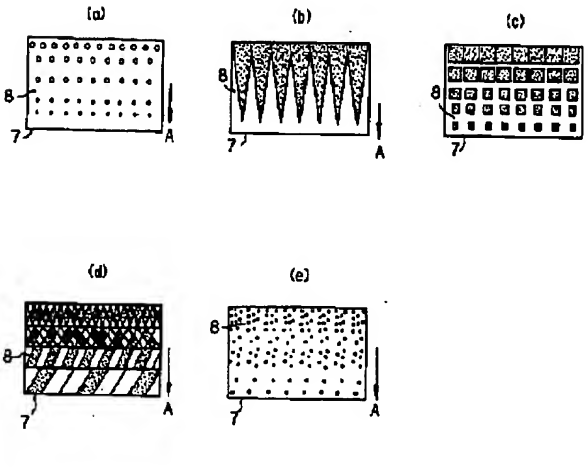

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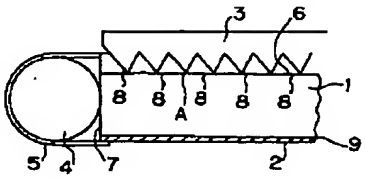
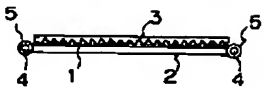


【図１０】



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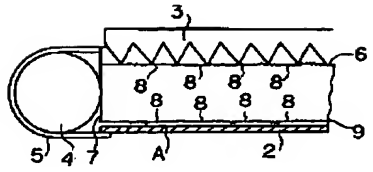
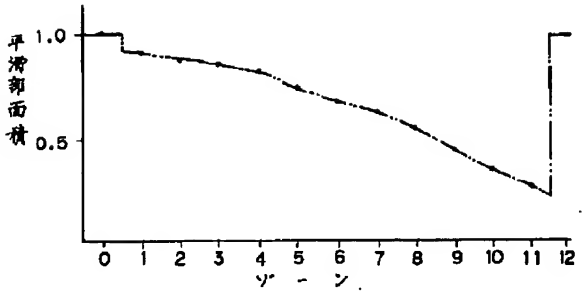
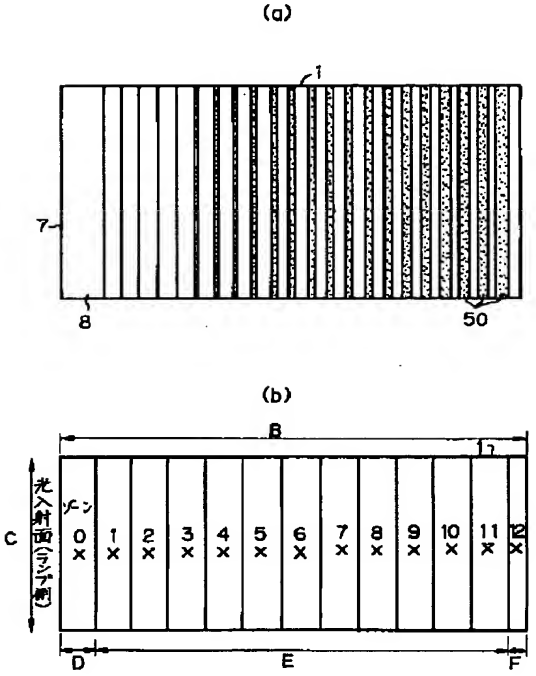


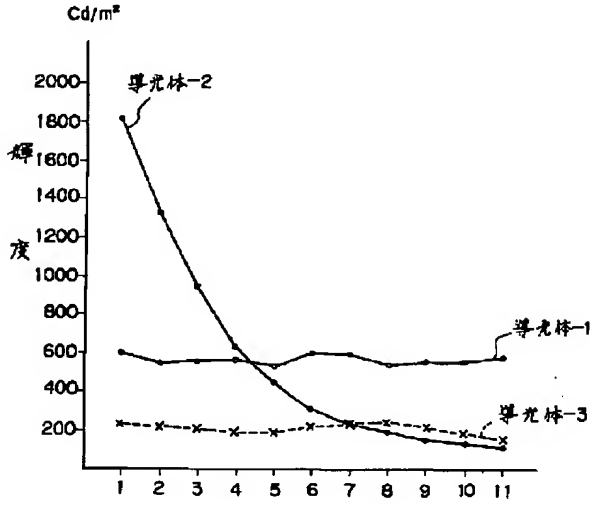
【図１１】



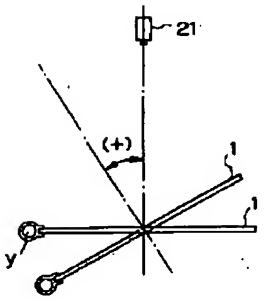
【図１２】



【図１３】



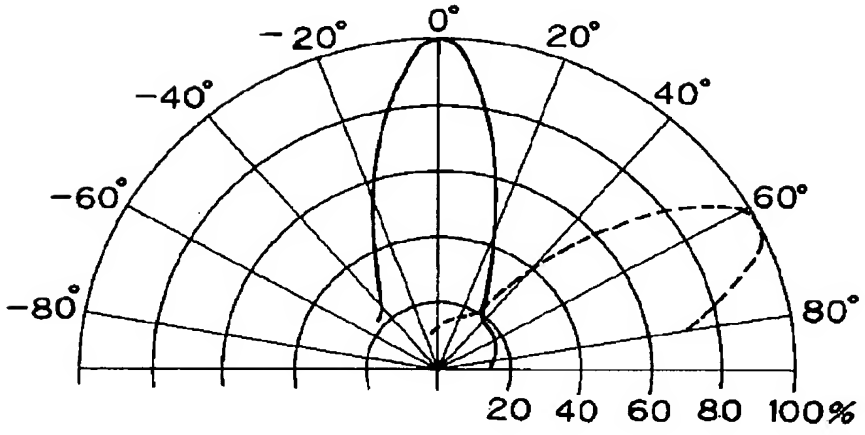
【図１４】



【図１５】

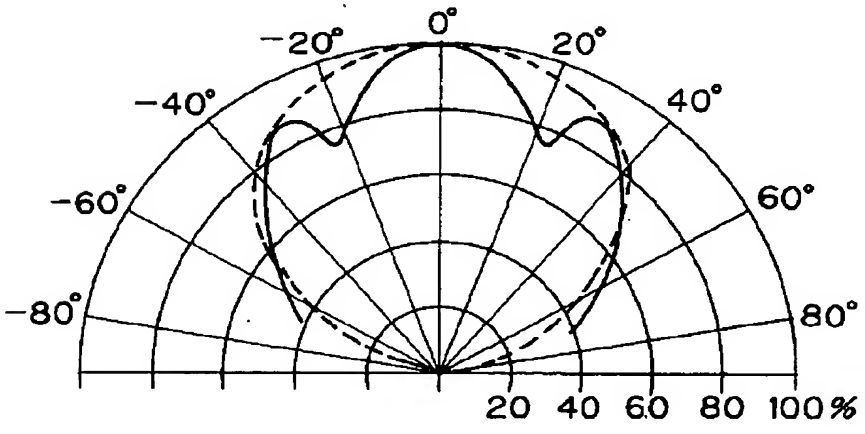
（ａ）導光体－１

…試料　１－①　＋65°の輝度　551Cd／m²
－試料　１－②　０°の輝度　612Cd／m²



（ｂ）導光体－２

…試料　３－①　０°の輝度　196Cd／m²
－試料　３－②　０°の輝度　212Cd／m²



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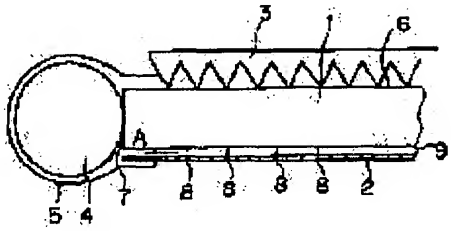
CHIBA KAZUKIYO

(54) SURFACE LIGHT SOURCE ELEMENT

(57)Abstract:

PURPOSE: To provide the surface light source element which is suitable as a back illuminating means of a liquid crystal display element, etc., and emits light with uniform luminance from the whole surface, and also, whose efficiency is high.

CONSTITUTION: A side face 7 of a transparent light guiding body 1 is set as an incident surface and a light source 4 is allowed to adhere closely, and also, by a reflector 5, light of the light source 4 is guided into the light guiding body 1 without waste. An emitting surface 6 of the light guiding body 1 is smoothed and decreases a loss of an emitted light. To the emitting surface 6, an element 3 having a prism unit is allowed to adhere closely, and also, the opposite surface 9 of the emitting surface 6 of the transparent light guiding body 1 is constituted so that the part whose surface is roughened and a smooth part 8 exist alternately, and moreover, a ratio of the smooth part increases as it draws near the light incident surface 7. Also, the reflecting surface 2 is provided in the vicinity of the opposite surface 9.



LEGAL STATUS

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[Date of sending the examiner's decision of rejection]	24.10.1995
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	07-25107
[Date of requesting appeal against examiner's decision of rejection]	22.11.1995

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The transparent transparent material which made at least one side edge optical plane of incidence, and made one field which intersects perpendicularly with this the optical outgoing radiation side, and equipped the opposite side of this optical outgoing radiation side with the light reflex layer (1)
It consists of elements (2) which have the prism unit of a large number to which the outgoing radiation of the light is made to carry out the light from the optical outgoing radiation side of this transparent transparent material in the predetermined direction. The directive outgoing radiation function the outgoing radiation of the light which carried out incidence is made [function] to carry out [function] in the direction of slant to at least one side of the optical outgoing radiation side and opposite side of a transparent transparent material from the optical plane of incidence of a transparent transparent material to the travelling direction of the light concerned, The surface light source element characterized by giving the control function which makes the brightness value of the light which carries out outgoing radiation from an optical outgoing radiation side equalize all over an optical outgoing radiation side.
[Claim 2] The surface light source element according to claim 1 characterized by giving the control function which makes the brightness value of the light which is equipped with the following, prepares a smooth portion in the optical outgoing radiation side split-face-ized [above], is made to increase the rate of this smooth portion as the aforementioned optical plane of incidence is approached, and carries out outgoing radiation from an optical outgoing radiation side equalize all over an optical outgoing radiation side. The split-face-ized optical outgoing radiation side in which a transparent transparent material has a directive light outgoing radiation function. Optical plane of incidence formed in the at least one edge side. The light reflex layer prepared in the opposite side of this optical outgoing radiation side.
[Claim 3] The surface light source element according to claim 1 characterized by giving the control function which makes the brightness value of the light which is equipped with the following, prepares a smooth portion in the opposite side split-face-ized [above], is made to increase the rate of this smooth portion as the aforementioned optical plane of incidence is approached, and carries out outgoing radiation from an optical outgoing radiation side equalize all over an optical outgoing radiation side. A transparent transparent material is an optical outgoing radiation side. Optical plane of incidence formed in the at least one edge side. The opposite side of the split-face-ized optical outgoing radiation side with a directive light outgoing radiation function. The light reflex layer prepared in this opposite side.
[Claim 4] The surface light source element according to claim 1 characterized by giving the control function which makes the brightness value of the light which prepares a smooth portion in the optical outgoing radiation side characterized by providing the following, is made to increase the rate of this smooth portion as the aforementioned optical plane of incidence is approached, and carries out outgoing radiation from an optical outgoing radiation side equalize all over an optical outgoing radiation side. The optical outgoing radiation side where a transparent transparent material has many lens units with a directive light outgoing radiation function. Optical plane of incidence formed in the at least one edge side. It has the light reflex layer prepared in the opposite side of this optical outgoing radiation side, and is the lens unit of aforementioned a large number.
[Claim 5] The surface light source element according to claim 1 characterized by giving the control function which makes the brightness value of the light which prepares a smooth portion in the opposite side characterized by providing the following, is made to increase the rate of this smooth portion as the aforementioned optical plane of incidence is approached, and carries out outgoing radiation from an optical outgoing radiation side equalize all over an optical outgoing radiation side. A transparent transparent material is an optical outgoing radiation side. Optical plane of incidence formed in the at least one edge side. The opposite side of the optical outgoing radiation side which has many lens units with a directive outgoing radiation function. It has the light reflex layer prepared in this opposite side, and is the lens unit of these large number.

[Claim 6] The surface light source element according to claim 1 characterized by using the transparent transparent material obtained by injection molding as a transparent transparent material.
[Claim 7] The surface light source element according to claim 2 characterized by using the transparent transparent material obtained by injection molding as a transparent transparent material.
[Claim 8] The surface light source element according to claim 3 characterized by using the transparent transparent material obtained by injection molding as a transparent transparent material.
[Claim 9] The surface light source element according to claim 4 characterized by using the transparent transparent material obtained by injection molding as a transparent transparent material.
[Claim 10] The surface light source element according to claim 5 characterized by using the transparent transparent material obtained by injection molding as a transparent transparent material.
[Claim 11] The surface light source element according to claim 2 characterized by the haze value of the split face formed in the transparent transparent material being 30% or more.
[Claim 12] The surface light source element according to claim 3 characterized by the haze value of the split face formed in the transparent transparent material being 30% or more.
[Claim 13] The surface light source element according to claim 1 characterized by the transparent transparent material consisting of acrylic resin.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to what can be especially used suitably as backlighting meanses, such as a liquid crystal display element, about the surface light source element used for surface light source equipment.
[0002]
[Description of the Prior Art] as backlighting (back light) meanses, such as the former and a liquid crystal display, -- the light source -- a line -- the structure which put on the focus of a rotation parabola type reflector, and put the diffusion board of opalescence on the on-ramp section using the lamp is common In the equipment of this structure, improvement is achieved by adjusting the configuration of a reflector, and the diffusion coefficient of a diffusion board.
[0003] moreover, a line -- a lamp and a transparent material are combined, the configuration of a transparent material is simulated by point light source approximation, and there are equipment into which the approximation curvilinear configuration was processed so that the outgoing radiation light of a certain direction might be condensed, equipment into which the thickness of a transparent material was changed along with the travelling direction of light, equipment which used the lenticular sheet which changed the prism angle according to the distance from the light source, a thing which combined these further
[0004] In recent years, although used as a liquid crystal display element, if it is going to raise display quality using the conventional surface light source element and a surface light source element will become the large-sized display of 10-12 inch size especially, thickness of only a surface light source element portion cannot be set to 20-30mm, and it cannot fill the request as a thin surface light source element.
[0005] The surface light source equipment of the edge light method which makes tabular transparent materials, such as acrylic resin, a transparent transparent material, carries out incidence of the light from the edge of this transparent transparent material on the other hand, and carries out outgoing radiation of the light from the upper surface or the inferior surface of tongue of a transparent material is proposed variously. However, in a liquid crystal display with large-sized 10-12 inch size, according to the distance from the light source, it was not able to become dark, and nonuniformity arose and a good display was not necessarily able to be performed.
[0006] On the other hand, although meanses, like making thickness of a transparent material thin according to the distance from a lamp etc. changes the course of light geometrically are provided, it is necessary to consider as the special configuration which needs precise processing, and un-arranging is on a manufacturing cost. And the use efficiency of light was low.
[0007]
[Problem(s) to be Solved by the Invention] About the surface light source element of an edge light method recently to JP,1-245220,A The light-scattering matter is densely applied or adhered as it separates from the optical incidence section to the opposed face of the optical outgoing radiation side of a transparent material. Or the method of presentation which installed the light-scattering reflector, and applied or adhered the light-scattering matter to the front face similarly is indicated. Moreover, a fine spot (dispersion matter) is prepared in a transparent board front face at JP,1-107406,A, and the area-light equipment which can make the whole surface of an optical diffusion board bright uniformly is reported by by piling up two or more transparent boards with which the spot patterns differ mutually.
[0008] However, in these methods, since an inorganic substance [light impermeability / as dispersion matter] (in the cases of many white pigments, such as titanium oxide and a barium sulfate) is generally used, in case the light which shone upon this dispersion matter is scattered about, the loss of light, such as an optical absorption, occurs and the fall of the brightness of outgoing radiation light arises.

[0009] Oe has reported the optical dispersion equipment which prepared outgoing radiation light controller material, in order to establish a diffusion layer through the layer which shows the middle property of an optical transparent material and a diffusion layer on a transparent material and to obtain equalization of outgoing radiation light on it in JP,61-171001,U and a U.S. Pat. No. 4729068 official report.
[0010] Moreover, in JP,1-244490,A and JP,1-252933,A, this invention persons also made the optical outgoing radiation side of a transparent material, and one [at least] field of the confrontation the shape of a lens, and the crepe side, and proposed the surface light source element of the edge light method which arranges the outgoing radiation light controller material which has the light reflex pattern which balances the inverse number of an outgoing radiation light distribution on the optical outgoing radiation side, and an optical diffusion board.
[0011] Although the optical dispersion equipment and surface light source element which used these outgoing radiation light controller material showed the improvement effect which was excellent in respect of the homogeneity of outgoing radiation light, the light reflected in outgoing radiation light controller material could not be reused, but the bird clapper made the brightness of outgoing radiation light clear low to near the minimum value of the brightness before adjustment.
[0012] In JP,2-17,A and JP,2-84618,A, this invention persons made the optical outgoing radiation side of a transparent material, and one [at least] field of the confrontation the shape of a lens, and the crepe side, and proposed the surface light source element which installed the prism to which the outgoing radiation of the light is made to carry out in the predetermined direction on the optical outgoing radiation side. Although concentration light came to be obtained in the direction which surely a user looks at when these surface light source elements were used for the above-mentioned liquid crystal color personal computer equipment etc., what can be satisfied in respect of the homogeneity in the outgoing radiation side of outgoing radiation light was not obtained.
[0013] this invention aims at offering the super-thin shape surface light source element from which it becomes a uniform luminosity all over an optical outgoing radiation side, and the outgoing radiation light of high brightness is obtained in the predetermined direction.
[0014]
[Means for Solving the Problem] this invention person used to come to complete this invention, as a result of performing various examination in view of an above-mentioned situation.
[0015] The transparent transparent material which the surface light source element of this invention made at least one side edge optical plane of incidence, and made one field which intersects perpendicularly with this the optical outgoing radiation side, and equipped the opposite side of this optical outgoing radiation side with the light reflex layer (1), It consists of elements (2) which have the prism unit of a large number to which the outgoing radiation of the light is made to carry out the light from the optical outgoing radiation side of this transparent transparent material in the predetermined direction. The directive outgoing radiation function the outgoing radiation of the light which carried out incidence is made [function] to carry out [function] in the direction of slant to at least one side of the optical outgoing radiation side and opposite side of a transparent transparent material from the optical plane of incidence of a transparent transparent material to the travelling direction of the light concerned, It is characterized by giving the control function which makes the brightness value of the light which carries out outgoing radiation from an optical outgoing radiation side equalize all over an optical outgoing radiation side.
[0016] Although it decreases by the optical absorption inside the outgoing radiation from an optical outgoing radiation side, and a transparent material etc. as the quantity of light of the internal light which carried out incidence to the transparent material from optical plane of incidence separates from optical plane of incidence Since it was made to increase the rate of a smooth portion as the surface light source element of this invention approached optical plane of incidence, even if it makes a transparent transparent material into a thin shape, outgoing radiation of the light by which incidence was carried out is carried out with an almost uniform brightness value from the whole surface of an optical outgoing radiation side. Moreover, the outgoing radiation light of high brightness is obtained, without not consuming vainly the light by which incidence was carried out to the transparent transparent material, and making the wattage of the light source increase, since the use efficiency of light is high. It is installing the element which has the prism unit of a large number to which the outgoing radiation of the light is made to carry out light in the predetermined direction furthermore on a transparent transparent material, and the outgoing radiation light which has a high brightness value in a predetermined direction is obtained.
[0017] Therefore, according to this invention, the super-thin shape surface light source element from which it becomes a uniform luminosity all over an optical outgoing radiation side, and the outgoing radiation light of high brightness is obtained in a predetermined direction can be offered.
[0018] Hereafter, the surface light source equipment of this invention is further explained to a detail.

[0019] First, the fundamental principle of the surface light source element of this invention is explained. In an edge lighting configuration to which it is n=1.4-1.6, and the plane of incidence 7 and the outgoing radiation flat surface 6 of a transparent material 1 lie at right angles as shown in drawing 1 (a), light does not carry out outgoing radiation of the rate n of an optical refraction to the air of a transparent material to a critical angle being just over or below 45 degrees from an outgoing radiation flat surface theoretically in general. In addition, in drawing 1 (a), 4 is the reflector by which the light sources, such as a fluorescent lamp, and 5 were formed in the reflector, and 2 was formed in the opposite side of the outgoing radiation flat surface 6 of a transparent material 1.
[0020] Therefore, as generally shown in drawing 1 (b), it is referred to as flat-surface 6a which carried out light-scattering processing of the outgoing radiation flat surface 6, or setting a reflector 2 to scatter reflection side 9a is performed.
[0021] The place which considered dispersion processing of one side of a transparent material front face and its opposed face or both sides in order that this invention persons might enlarge most the outgoing radiation quantity of light from a transparent material, The method of preparing the lens unit of a large number to which the outgoing radiation of the light is made to carry out in the predetermined direction in the method of giving split-face processing for these front faces as uniformly as possible and these front faces The effective thing was found out compared with the method of making the layer of the dispersion matter forming in a front face at the time of the method of applying the dispersion matter to one side or the both sides of a transparent material front face and its opposed face, or an acrylic-board polymerization.
[0022] The brightness of outgoing radiation light is decreased, and if it becomes a 70 to 80 times as much distance as the thickness of a transparent material, it will become 1/10 or less [of the brightness value near the incidence edge], as it will separate from a fluorescent lamp, if, on the other hand, put the fluorescent lamp which twisted silver vacuum evaporationo polyester film as a reflector on the end side of the transparent material which gave split-face processing, it is close to a split-face processing side, silver vacuum evaporationo polyester film is arranged as a reflector and the brightness This is shown in line ** in drawing 2 .
[0023] In order to improve this uneven-ization, this invention persons proposed equalizing brightness with the translucency sheet for outgoing radiation light adjustment in a publication-number No. 244490 [one to] official report, and JP,1-252933,A, as point ** was carried out. However, by this method, although the homogeneity of the brightness of outgoing radiation light was attained, the brightness value as the whole outgoing radiation light fell to about 1 of the brightness value near the incidence edge / ten to 1.5/10, and use of a light energy which carried out incidence into the transparent material was not performed efficiently. This is shown in line ** in drawing 2 . The translucency sheet for outgoing radiation light adjustment itself is only what cuts the light which carries out outgoing radiation, and it depends this on the ability to reflect light and not to be reused in the adjustment pattern.
[0024] In order that this invention persons may use the light which carries out incidence from such a viewpoint as effectively as possible, then, the adjustment pattern of the translucency sheet for outgoing radiation light adjustment, Moreover, like JP,1-245220,A which carried out point **, outgoing radiation of light is not performed by applying to the confrontation of an optical outgoing radiation side densely as the dispersion matter is separated from the optical incidence section. By transparent transparent material which this invention persons have reported to JP,2-17,A, JP,2-84618,A, and JP,2-176629,A, by and the transparent transparent material with the amount of outgoing radiation large originally The outgoing radiation quantity of light was adjusted using the interface reflection with optical few losses, and equalization of the brightness value of outgoing radiation **** was tried.
[0025] At least to namely, one side of the optical outgoing radiation side and opposite side of a transparent transparent material While establishing the lens unit of a split face or a large number with the directive outgoing radiation function to which the outgoing radiation of the light which carried out incidence is made to carry out in the direction of slant from the optical plane of incidence of a transparent transparent material to the travelling direction of the light concerned Prepare a smooth portion in the field which has these split faces or many lens units, and moreover, the rate of the smooth portion is made to increase as optical plane of incidence is approached. By giving the control function which makes the brightness value of the light which carries out outgoing radiation from the optical outgoing radiation side of a transparent transparent material equalize in respect of [whole] optical outgoing radiation The brightness value as the whole outgoing radiation light could make it increase to the abbreviation 3/10 of the brightness value near the incidence edge, and found out that the transparent transparent material which moreover shows a brightness value uniform as the optical whole outgoing radiation side could be obtained. This is shown in line ** in drawing 2 . The surface light source element of this invention installs the element which has many prism units on this transparent transparent material in order to make the outgoing radiation of the light carry out in the predetermined direction effectively, using this transparent transparent material as point ** was carried out.

[0026]
[Example] The following examples explain the surface light source element of this invention concretely.
[0027] a part of IV-IV line of the equipment which shows one example of the backlighting (back light) equipment which included the surface light source element by this invention in surface light source element drawing 3 , and is shown in drawing 4 at drawing 3 -- a cross section is shown
[0028] This equipment consists of the square plate-like transparent material 1, an element 3 which has the prism unit installed in the optical outgoing radiation side 6 side, the light sources 4, such as one fluorescent lamp formed in the edge side (optical plane of incidence 7) of a transparent material 1, and a reflector 5 made to reflect light in plane of incidence by the reflector prepared in the inside while holding this light source 4. The light reflex layer 2 is formed in the opposite side of the optical outgoing radiation side 6 of a transparent material 1.
[0029] The feature of the surface light source element of this invention at least to one side of the optical outgoing radiation side and opposite side of a transparent material 1 While establishing a split face with the directive outgoing radiation function to which the outgoing radiation of the light which carried out incidence is made to carry out in the direction of slant from the optical plane of incidence 7 of a transparent material 1 to the travelling direction, or many lens units Prepare a smooth portion in the field which has these split faces or many lens units, and moreover, the rate of the smooth portion is made to increase as optical plane of incidence is approached. In order to make the outgoing radiation of the light which carried out outgoing radiation from the transparent material on having given the control function which makes the brightness value of the light which carries out outgoing radiation from the optical outgoing radiation side of a transparent material 1 equalize all over an optical outgoing radiation side, and this transparent material carry out in the predetermined direction, it is installing the element which has a prism unit.
[0030] The smooth portion 8 is formed in the opposite side 9 where the optical outgoing radiation side 6 was split-face-ized, and the rate of the smooth portion 8 consists of this example so that it may increase as are shown in the arrow A of drawing 4 and the optical plane of incidence 7 is approached.
[0031] It responds to the configuration of the rate which the smooth portion of a transparent material increases, and a smooth portion and a pattern, the quality of the material of a transparent material and a configuration, the kind of light source, the workability of optical outgoing radiation and a reflector, etc., and it can choose and change suitably and can determine.
[0032] The example of a pattern of a smooth portion is illustrated to drawing 5 (a) - (e). The rate of the smooth portion 8 increases it as are shown in the arrow A in drawing 5 and any [these] example approaches the optical plane of incidence 7.
[0033] In this invention, in order to make the outgoing radiation of the light carry out the light from the optical outgoing radiation side of a transparent transparent material in the predetermined direction, the element which has many prism units is used. As shown in drawing 1 (b), when dispersion processing of the outgoing radiation side is carried out and it considers as the outgoing radiation flat surfaces 6a and 9a, almost all light is carrying out outgoing radiation to the direction 60 - 70 degrees to the normal of an outgoing radiation side. In order to transform such a direction in the direction of a normal, the element which has many prism units is used.
[0034] It is drawing which expanded the prism of the element (2) which has the prism unit of a large number to which the outgoing radiation of the light is made to carry out the light from the optical outgoing radiation side of a transparent transparent material in the predetermined direction to drawing 6 (a) and (b). Setting to this drawing, 20 and 21 are the outgoing radiation light to the direction of right-hand side from a transparent transparent material (1), and the direction of left-hand side, theta 1, and theta 2, respectively. The angle which a normal and the prism sides 30 and 31 make, and 32 are outgoing radiation sides, respectively. Moreover, psi1 -psi6 And phi1 -phi6 How each area of a prism unit takes the angle for the angle to the datum line by being shown, respectively is as being shown in drawing 6 (a) and (b).
[0035] When carrying out incidence like [right-hand side / of prism] the outgoing radiation light 21, after carrying out incidence and carrying out total reflection in respect of / 31 / prism from the prism side 30, outgoing radiation is carried out at the predetermined angle psi 6 from the outgoing radiation side 32. Moreover, the outgoing radiation side 32 to predetermined angle phi 6 when carrying out incidence from the left-hand side of prism like the outgoing radiation light 20, after carrying out incidence and carrying out total reflection in respect of [30] prism from the prism side 31 Outgoing radiation is carried out. Although the outgoing radiation angle from a transparent material does not necessarily become symmetrical to a normal, it can acquire a desired outgoing radiation angle (psi 6 and phi 6) by changing a prism angle (theta 1 of drawing 7 , and theta 2).
[0036] Only laying everything but the method by the compulsive adhesion by adhesion according only a transparent material edge to adhesives etc. or sticking by pressure can even perform installation to the transparent material of an element (2) which has a prism unit. Moreover, between a transparent material and elements (2) can be stuck, or a

laminating can also be carried out through a thin air space.
[0037] In this invention, a transparent transparent material (1) can be obtained from transparent inorganic material, such as transparent resins, such as acrylic resin, polycarbonate resin, and vinyl chloride resin, glass, and a quartz, and the large acrylic resin of especially a visible light transmittance is suitable for it. The forming method of this transparent material 1 can be chosen and changed suitably, and can be performed.
[0038] the line which especially the light source 4 in this invention was not limited, but continued -- the light equipment which combined the light source prepared in the edge plane of incidence of the optical-transmission object which carries out the light leak of the light, and this optical-transmission object can be used as the light source from the fluorescent lamp and filament lamp which are the light source, two or more point light sources arranged along with plane of incidence, and the side
[0039] The reflecting layer 2 of the surface light source element in this invention can carry out the laminating of the reflective film which deposited metals (silver, aluminum, etc.), and can form it in a film. As this reflector, what has a high reflection factor is desirable.
[0040] In this invention, the lens unit of a large number to which at least one side of the optical outgoing radiation side 6 and its opposite side is split-face-ized, or makes the outgoing radiation of the light, as for a transparent material 1, carry out in the predetermined direction needs to be formed. Moreover, it needs to be prepared in the field in which it was split-face-ized or many lens units were formed so that it may increase as a smooth portion approaches optical plane of incidence.
[0041] If it is in the desirable mode of this invention, as for the front face of the smooth portion 8 of a transparent material 1, it is desirable that it is an optical surface, and being mirror-plane-ized especially is desirable. It is because most light which carried out incidence of this with the incident angle more than critical angle of reflection to the optical surface can use light effectively since it is reflected without losing and disclosure light does not become, and they can raise the brightness of the optical whole outgoing radiation side.
[0042] The lens unit of a configuration which it was not limited, for example, this invention persons have proposed by JP,2-17,A can be used especially for the configuration of a lens unit where it is used by this invention.
[0043] The lens 40 which has various lens configurations in drawing 7 (a) and (b) is illustrated.
[0044] A certain thing especially has the haze value of a split-face-ized portion desirable as a performance of the split-face-ized field in which it is used by this invention, 50% or more about 30% or more.
[0045] The surface light source element of this invention is not limited to the above-mentioned example, but various modifications are possible for it. For example, although the smooth portion 8 is formed in the opposite side 9 where the optical outgoing radiation side 6 was split-face-ized in the above-mentioned example, as shown in drawing 8 , the smooth portion 8 can be formed in the split-face-ized optical outgoing radiation side 6, and it can also consider as the composition to which the rate of area of the smooth portion 8 is made to increase as are shown in the arrow A in drawing 8 and the optical plane of incidence 7 is approached.
[0046] Furthermore, as shown in drawing 9 , a smooth portion can be prepared in both sides by which the optical outgoing radiation side 6 and its opposite side 9 were split-face-ized, and it can also consider as the composition to which the rate of area of a smooth portion is made to increase as are shown in the arrow A of drawing 9 and the optical plane of incidence 7 is approached.
[0047] Moreover, although considered as the composition which formed the light source 4 only in the end side of a transparent material 1 in the above-mentioned example, as shown in drawing 10 , the light source 4 can also be arranged to the both ends of a transparent material 1.
[0048] The surface light source element by invention of adjustment ****** of a surface light source element can be adjusted and manufactured by various methods.
[0049] For example, when preparing a smooth portion in the field which has the field or lens unit of a transparent material split-face-ized in this invention, even if it uses which method of the method of preparing a smooth portion in the field which has the field or lens unit split-face-ized, and the method of preparing a split-face-ized portion or a lens unit in a smooth side, the target transparent material can be produced. For example, the metal mold which has the metal mold which has a desired split-face pattern and desired surface roughness, or a specific lens unit and a specific smooth portion by split-face-ized processing of sandblasting, etching, etc. is prepared, a resin is fabricated with injection or a heat press using such metal mold, and or it was split-face-ized, the transparent material which prepared the predetermined smooth portion at least in one side of the optical outgoing radiation side which has a lens unit, and its opposite side can be obtained. The injection-molding method is especially excellent in the point of precision and forming speed, and it is the desirable fabricating method.
[0050] Manufacture of a surface light source element can prepare each part material, such as a transparent material,

prism, and a charge of a reflector, and can be carried out by assembling these.
[0051] A glass bead is sprayed on one side of a detailed example (transparent material public-funds type production) polishing brass board, and the board which carried out split-face processing of the metal plate front face uniformly by the homing method of a conventional method is produced (metal mold -1).
[0052] The rate distribution of area of the smooth section produces in CAD a gradation pattern which serves as a distribution shown in drawing 11 . the front face of metal mold -1 -- the phot of a conventional method -- the lithography method -- a photograph -- a pattern is printed and developed optically, a portion (the same portion as the split-face portion 50 shown in drawing 12 (a)) to leave as a split face is protected by the coat, and the remaining portion is ground so that it may become the degree grade of emery #800 ** Then, the metal mold which removes a protective coat and has the predetermined smooth section is produced (metal mold -2).
[0053] Apart from these, emery #800 buffing of the front face of a brass board is carried out, and a mirror-plane board is produced (metal mold -3).
[0054] nesting for injection molding which has the field as metal mold -3 where the field of another side is the same in respect of one field being the same as metal mold -2 -- metal mold is produced (metal mold -4)
[0055] (Production of a transparent material) Acrylic resin board 150mmx250mm with a thickness of 3mm is put between metal mold -2 and metal mold -3, and a replica is taken with a heat press as a conventional method. Four sides which cut so that it might become size and a pattern position as furthermore shown in drawing 12 (a) and (b), and were cut are ground so that it may become a mirror plane by the conventional method (transparent material -1).
[0056] The sign 50 in drawing 12 (a) is a split-face portion, and the size of a transparent material 1 is (width-of-face F) 5mm of (Length B) 225mm, (Width C) 132mm, (width-of-face D) 15mm of a zone 0, the effective width (E : width of face of zones 1-11) of 205mm, and a zone 12 in drawing 12 (b).
[0057] Acrylic resin board 150mmx250mm with a thickness of 3mm is put between metal mold -1 and metal mold -3 in the completely same process, and a replica is taken with a heat press, it cuts and grinds, and a transparent material is produced (transparent material -2).
[0058] As an example of comparison, negative EP drawing from which ink is printed by the split-face equivalent portion of metal mold -2 by screen-stencil is produced, and the lithographic plate of screen-stencil is produced using this. After screen-stenciling using commercial white ink (SEIKO Advance VIC 120 white) on acrylic resin board 150mmx250mm one side with a thickness of 3mm, it cuts and grinds like a transparent material -1 and a transparent material -2, and the transparent material for comparison is produced (transparent material -3).
[0059] With a 200t injection molding machine, a transparent material is produced at 280 degrees C of cylinder temperatures using metal mold -4 from an acrylic resin pellet (AKURI pet VH Mitsubishi Rayon Co., Ltd.) (transparent material -4).
[0060] (Haze-value measurement of a transparent material -2) From the split-face section of a transparent material -2, the 50mmx50mm piece of paper was cut down, the haze value was measured according to ASTM-D 1003-61, and it asked for the haze value by the following formula.
[0061] The haze value of haze-value ={(diffused-light permeability)/(all light transmissions)} x100%, consequently a transparent material -2 was 64.8.
(Manufacture of an element (2)) The prism angle was made isotropic and it considered as 63 degrees of overhead angles so that it might become the direction of a normal from installing a lamp in a shorter side one LGT about the outgoing radiation angle from a final surface light source element (theta1 =theta2 =31.5 degree).
[0062] It is a multi-prism pattern with a point angle [of prism] of 63 degrees, and pitch 0.38mm metal mold was created, hot printing was carried out to the acrylic resin board with a thickness of 1mm with a heat press, and it considered as the element (2) which has a prism unit.
[0063] (Assembly of a surface light source element) The film which carried out the reflecting layer and performed silver vacuum evaporationo to 100micro polyester film was cut to 132mmx225mm. This is made into a light reflex object. RAMPUKE-SU ****ed the white section of the crystal white Made from Sky Aluminum (one side white paint aluminum board thickness of 0.25mm) inside, and created a cylinder with an aperture which serves as 3mm of openings with the bore phi of 6mm.
[0064] A transparent material is laid, the element (2) which has a prism unit is further laid on it so that zero zone of drawing 12 (b) may come and a split face or a printing side may approach the silver vacuum evaporationo side of a reflecting layer, these three points are summarized to the shorter side of a transparent material, and it puts in it at the aperture section of a lamp case. The lamp of KC162Tmade from Matsushita Electrical machinery Industry4E54B (4mm phix162mm) is inserted in this lamp case, and it considers as a surface light source element. Using CXA-Lby TDK Corp. 10L, the inverter for lamp lighting impresses DC12V, and lights up.

[0065] (Measurement of luminance of a surface light source element) A luminance meter is measured using BM-5 of TOPCON CORP. with the angle of visibility of 1 degree, and 10-15mm of measurement circles phi. Point of measurement measures the center section of the zone 1 shown in drawing 13 - the zone 11. A lamp is turned up, is carried at right angles to a predetermined measurement base, it fixes, and all surface light source elements impress DC12V, and measure them through a lamp ageing time after lighting 15 minutes or more. Measurement temperature was 23-degree-C **2-degree C conditions.
[0066] (Measurement-of-luminance result) The measurement result of brightness is shown in Table 1 and drawing 13 .
[0067]
[Table 1]]

ゾーン	本発明例		比較例			
	導光体－1		導光体－2		導光体－3	
	輝度	分布	輝度	分布	輝度	分布
1	596	0.992	1810	1.000	238	0.979
2	539	0.897	1340	0.740	218	0.897
3	548	0.912	944	0.522	207	0.852
4	557	0.927	619	0.342	191	0.786
5	526	0.875	438	0.242	193	0.794
6	601	1.000	311	0.172	222	0.914
7	593	0.987	234	0.129	232	0.955
8	535	0.890	188	0.104	243	1.000
9	547	0.910	155	0.086	221	0.909
10	554	0.922	130	0.072	193	0.794
11	567	0.943	110	0.061	195	0.802
平均	560		571		214	

[0068] (Measurement of the angular distribution of an optical outgoing radiation light of a transparent material and a surface light source element) The brightness of the position which laid the sample so that Lamp y might be located on left-hand side on a measurement base, was made to rotate a sample as shown in drawing 14 , and was decided at an angle of predetermined is measured.
[0069] The sample which removed the element (2) which has a prism unit from the surface light source element using the transparent material -1 is made into 1-**, and the sample which laid the element (2) is made into 1-**. The sample which removed the element (2) from the surface light source element using the transparent material -3 is made into 3-**, and the sample which laid the element (2) is made into 3-**.
[0070] In any case, point of measurement is fixed in the center of the zone 6 of drawing 12 (b). A result is shown in drawing 15 (a) and (b).
[0071] In the transparent material -1 which is an example of this invention, outgoing radiation of the outgoing radiation light of almost uniform brightness is carried out from the optical whole outgoing radiation side surface so that clearly from Table 1, drawing 13 , and drawing 15 . And an optical outgoing radiation light in case there is no element (2) which is the main point of this invention is a distribution light which has peak brightness in 65 degrees like the example of measurement of drawing 15 (a) sample 1-**, and when an element (2) is ****(ed), it turns into distribution light to which almost all outgoing radiation light has peak brightness in the direction of a normal of a sample (drawing 15 (a) sample 1-**). Although outgoing radiation of the outgoing radiation light of almost uniform brightness is carried out from the optical whole outgoing radiation side surface as the sample 3 which is an example of comparison on the other hand is also shown in Table 1 and drawing 13 , it is the distribution light which has peak brightness in the

direction of 0 degree even if there is no element (2), as shown in drawing 15 sample 3-**, and even if it installs an element (2), the direction of outgoing radiation of peak brightness does not change. And although the size, the used lamp, and power consumption of a sample do not change, the brightness value of the direction of a normal of a sample of a surprising thing is about 2.5 times higher in the example of this invention, and the example of comparison. Moreover, the completely same result as the surface light source element which also produced the surface light source element produced from the transparent material -4 from the transparent material -1 was obtained.

[0072]

[Effect of the Invention] The directive outgoing radiation function the surface light source element of this invention makes [function] the outgoing radiation of the light which carried out incidence carry out [function] in the direction of slant to at least one side of the optical outgoing radiation side and opposite side of a transparent transparent material from the optical plane of incidence of a transparent transparent material to the travelling direction of the light concerned, The control function which makes the brightness value of the light which carries out outgoing radiation from an optical outgoing radiation side equalize all over an optical outgoing radiation side is given. And even if it makes a transparent transparent material into a thin shape by preparing the element (2) which has the prism unit of a large number to which the outgoing radiation of the light is made to carry out the light from the optical outgoing radiation side of this transparent transparent material in the predetermined direction, outgoing radiation of the light by which incidence was carried out is carried out in the predetermined direction with an almost uniform brightness value from the whole surface of an optical outgoing radiation side. Moreover, the outgoing radiation light of high brightness is obtained, without this transparent transparent material making the wattage of the light source increase, since the use efficiency of light is high.

[0073] Therefore, according to this invention, the super-thin shape surface light source element from which it becomes a uniform luminosity all over an optical outgoing radiation side, and the outgoing radiation light of high brightness is obtained in a predetermined direction can be offered.

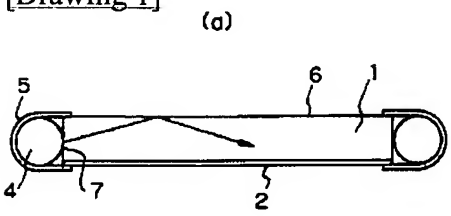
[Translation done.]

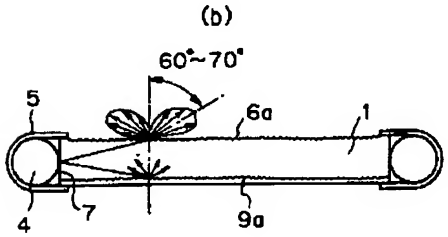
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

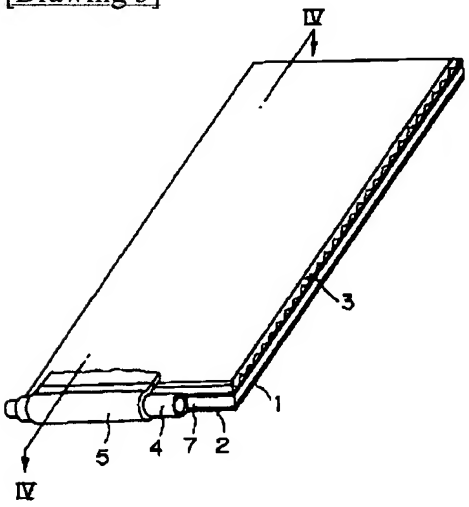
DRAWINGS

[Drawing 1]

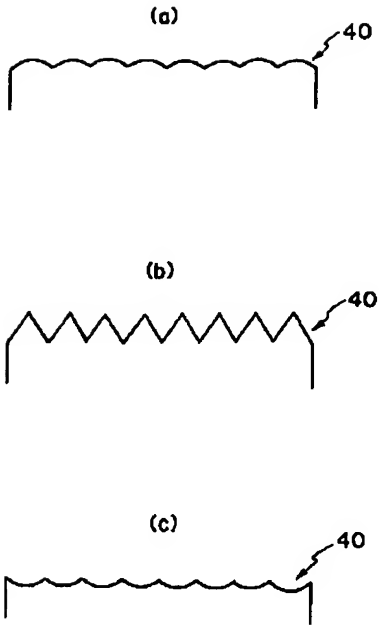




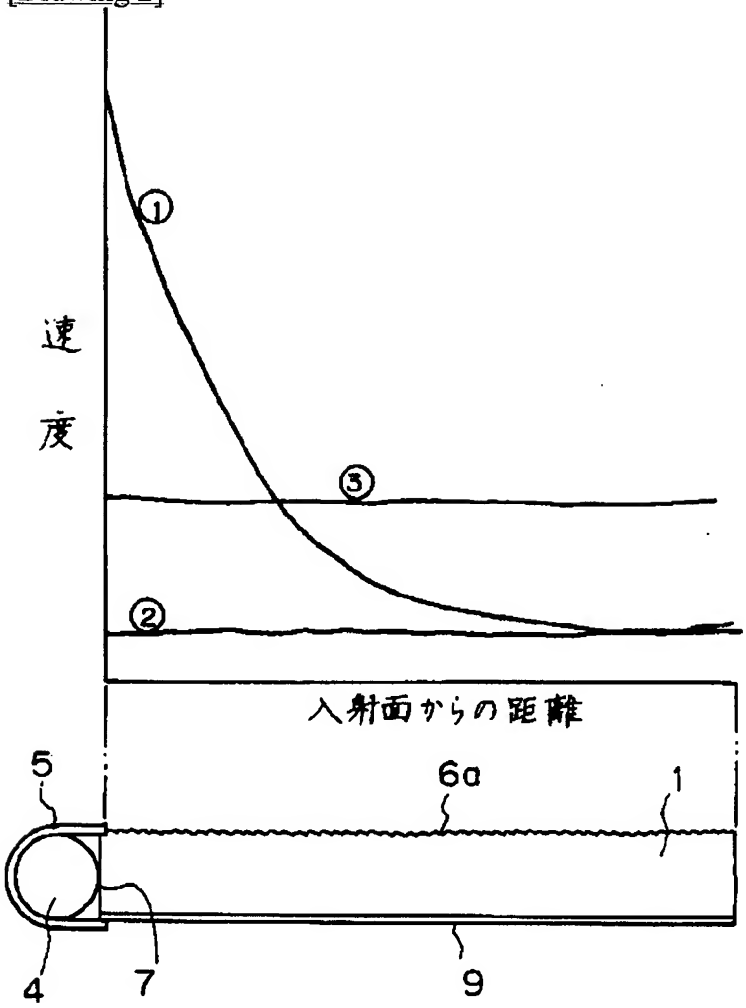
[Drawing 3]



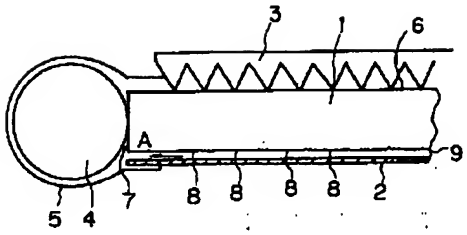
[Drawing 7]



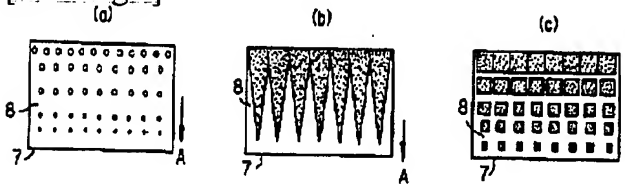
[Drawing 2]

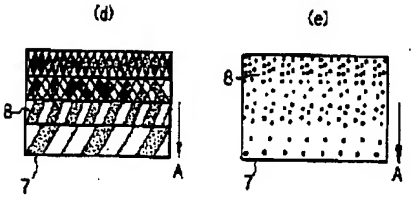


[Drawing 4]

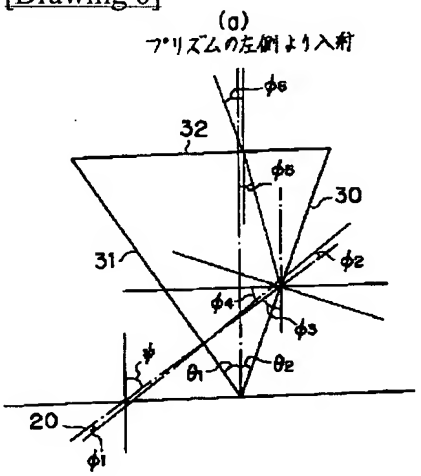


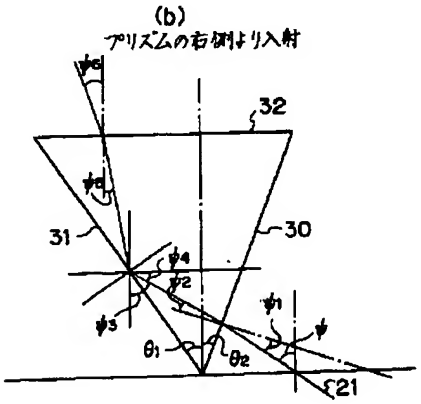
[Drawing 5]



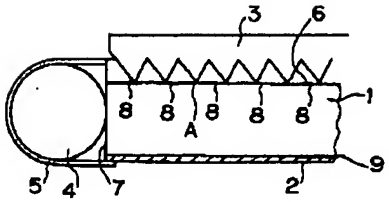


[Drawing 6]

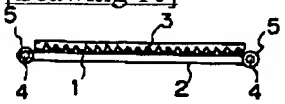




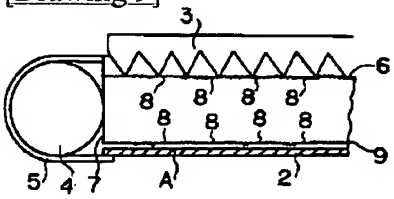
[Drawing 8]



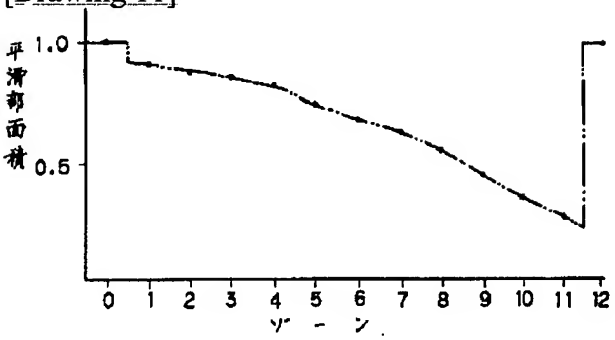
[Drawing 10]



[Drawing 9]

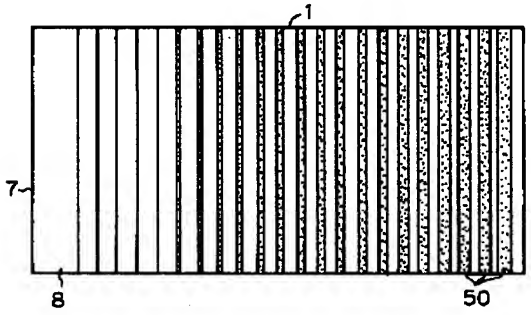


[Drawing 11]

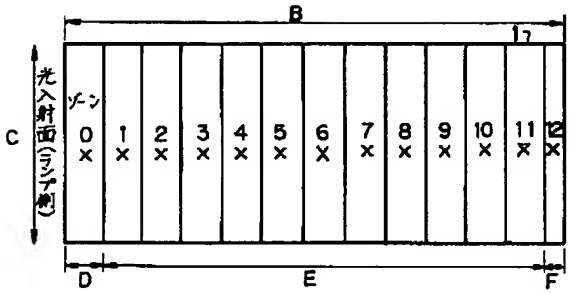


[Drawing 12]

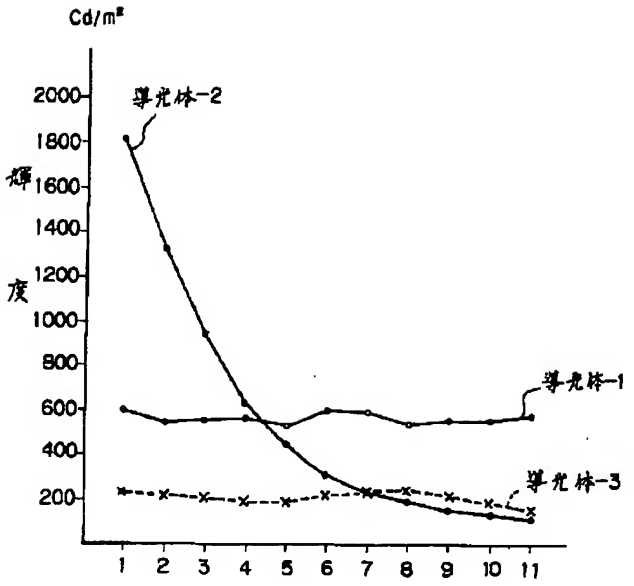
(a)



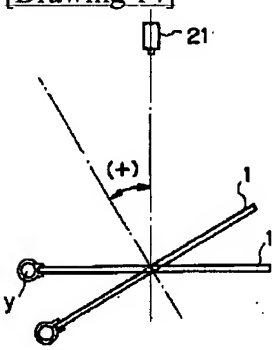
(b)



[Drawing 13]



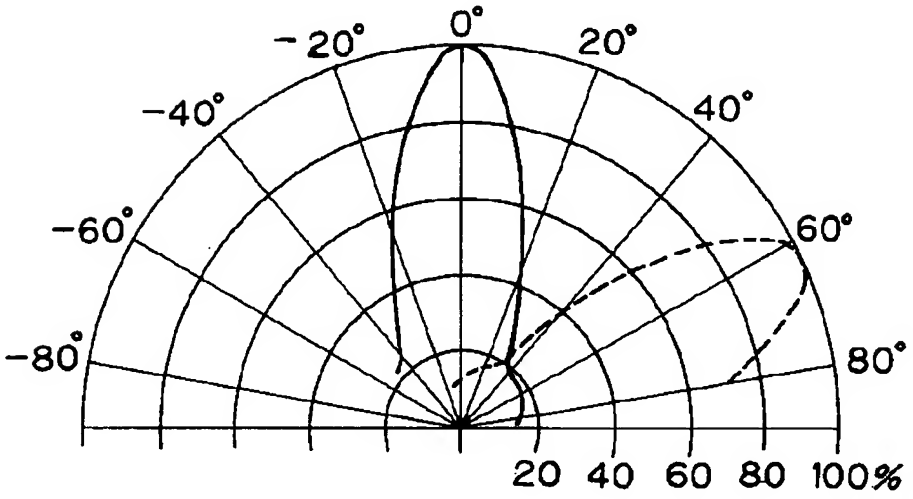
[Drawing 14]



[Drawing 15]

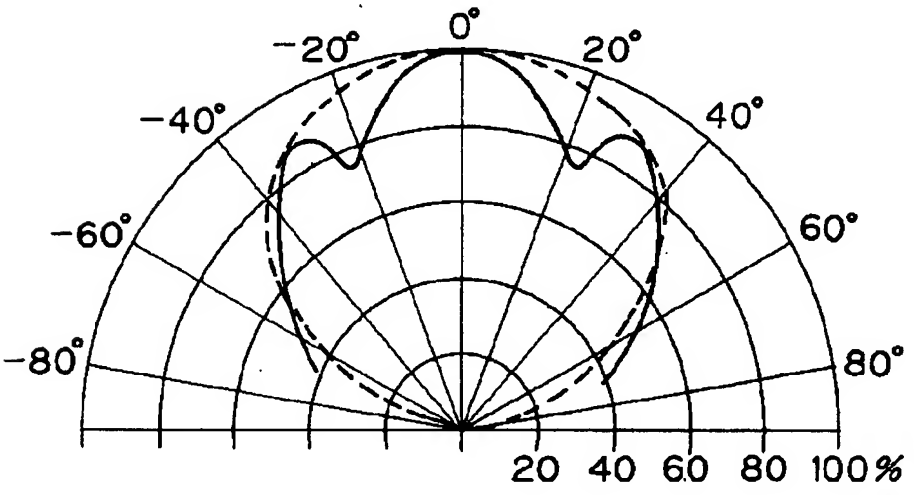
（ａ）導光体－１

…試料　１－①　＋65°の輝度　551Cd／m²
－試料　１－②　０°の輝度　612Cd／m²



（ｂ）導光体－２

…試料　３－①　０°の輝度　196Cd／m²
－試料　３－②　０°の輝度　212Cd／m²



[Translation done.]